

Tutorial 8: Image and Video Source Identification

Thanks to the worldwide spreading of smart portable devices, every day an enormous amount of digital multimedia information is created, stored and shared among peer users by means of social media, web portals, apps. Such tools enable the diffusion of user-generated multimedia content in an extremely easy and wide manner, such that anybody has the opportunity to disseminate images, videos and audio tracks. However, the authenticity and trustworthiness of such multimedia data cannot be given for granted, as low-cost and user-friendly editing software allow nowadays for easy manipulations of such material even by non-expert people. Considering also the more intuitive and immediate impact of visual data with respect to textual documents, the potential diffusion of distorted or completely fake visual content represents an urgent issue to be addressed. Recently, the debate about the role of visual content manipulation used online, like *deep fakes*, has significantly attracted the attention of the international community, questioning the way that the use of manipulated images and videos impact users' perceptions.

It is the aim of this tutorial to provide a tour in the subject of image and video source identification. Source identification methods belong to the research area of multimedia forensics, which aims at authenticating digital media by identifying their source and by detecting possible digital forgeries.

After an introduction on problems and motivations, and on the basic principles of multimedia forensics, possible solutions proposed by image and video forensics for acquiring information on the history of multimedia signals, with particular reference to the device that generated it, will be presented, according to the following outline:

- *Source identification through sensor noise detection*: this approach is based on the fact that pixels have different sensitivity to illumination, which is modeled as a reference pattern noise, better known as Photo-Response Non-Uniformity noise (PRNU), which uniquely identifies a CMOS or CCD sensor, and thus the corresponding imaging device. The first part of the tutorial will explain in detail this well-established technique.
- *Source identification through file format analysis*: image and video standards prescribe only a limited number of characteristics for the data container formats, thus leaving a lot of discretion to the device manufacturers and the software developers; this fact leads to differences between the files generated by different devices or editing tools that can be exploited for forensic purposes. In this part of the tutorial, it will be shown how to exploit these dissimilarities for source identification.
- *Current challenges: source identification in presence of digital stabilization, HDR content, new compression formats*: image capturing devices have developed rapidly in the past decade, providing a wide range of new options and features, that can hinder the detection of the sensor noise. In this part of the tutorial, it will be shown how it is possible to solve the detection issues in presence of such difficult conditions.

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